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ABSTRACT

In the spring of 1990, an evaluation was conducted of Saginaw, Michigan's Laser Learning Project (LLP), which was designed to provide eighth grade students with an alternative mathematics instructional program using specially designed curriculum and interactive video. It was hypothesized that participating students would not only achieve higher academic mathematics scores during the 6-week project, but would also adopt a more positive attitude towards mathematics. It was found that the students who participated in the experimental project had significantly better mathematics achievement scores on three of the four objectives studied than students in the traditional classes, but there was no difference in attitudes towards mathematics between the experimental and control groups. Based on the findings the following guidelines have been recommended: (1) use the interactive video system for review only; (2) due to the reading level of the text contained in the program, use the system in a high school setting; and (3) provide students with sufficient access to the system. A list of nine mathematics objectives defined as essential at the eighth grade level and statistical information from the study are appended. (DB)

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EVALUATION REPORT

LASER LEARNING PROJECT (LLP)

1989-90

DEPARTMENT OF EVALUATION SERVICES

- PROVIDING ASSESSMENT, PROGRAM EVALUATION AND RESEARCH SERVICES -

SCHOOL DISTRICT OF THE CITY OF SAGINAW

Saginaw, Michigan

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LASER LEARNING PROJECT (LLP)

1989-90

An Approved Report of the
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INTRODUCTION

In 1989-90, the School District for the City of Saginaw participated in Laser Learning Project (LLP). Initiated through the Dow Corning/Mid-Michigan Minorities Pre-Engineering Program (M^3PEP), LLP was designed to provide students who were unsuccessful in traditional mathematics classrooms with a classroom setting in which specially designed curriculum and interactive video discs (computers) were used.

This specially designed curriculum consisted of seven strands[1] which were broken down into 74 lessons.

In order to determine the effectiveness of this alternate instructional approach, a study testing two hypotheses was conducted. The two hypotheses were:

1. Students who participated in the project would realize significantly higher mathematics achievement scores than those who did not participate, and

2. Students who participated in the project would have a significantly more positive attitude toward mathematics than non-participants.

The remainder of this report details this study, beginning with the procedures in the next section.

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[1] These strands were: whole numbers, fractions, decimals and percents, measurements and geometry, graphs and charts, introduction to algebra, and life skills. The stands matched some of the essential learnings established by the district for general mathematics.

PROCEDURES

In order to test the two hypotheses, two groups of students were chosen. Each group was composed of three eighth grade classrooms: two compensatory education[2] and one general mathematics. One of these groups, the project group (n=48), participated in the alternate classroom for six weeks (beginning March 22, 1990). The other group, the control group (n=22), remained in a traditional mathematics classroom.

Mathematics achievement was measured through the mathematics portion of a locally developed, criterion reference test, Essential Learnings Assessment Program (ELAP). ELAP covers nine objectives (described in Appendix A) which were defined as essential by eighth grade general mathematics teachers and district curriculum specialists. The test has four items for each objective and objective mastery is defined as at least three items correct. It was administered district-wide in late Spring, 1990 and scores for students in the project and control groups were identified for analysis.

Attitude toward mathematics was measured by the Test of Mathematical Abilities (TOMA), Attitude Toward Math. The initial study design called for the TOMA to be administered on a pre- and post-test basis, however, it was only administered at the end of the six-week project period.

In addition to testing the hypotheses, an interview with the project teacher was conducted to determine student attitude and how well the project was implemented.

In the next section, the results of the hypotheses tests and the findings of the interview will be presented.

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[2]These classes were composed of students who scored at or below the twenty-fifth percentile in mathematics on the California Achievement Tests (CAT) Form E.

RESULTS

It was hypothesized that students who had participated in the Laser Learning Project (LLP) would perform significantly better on measures of mathematics ability and attitude than would non-participating students. Below are the results of tests of these hypotheses.

MATHEMATICS ABILITY

A comparison between objectives covered in the six-week project and the objectives identified in ELAP (second semester, eighth grade) showed alignment on four objectives (described in Appendix A). Table 1 displays the results of a one-way analysis of variance (ANOVA) examining the differences between project and control group students in items correct on these four objectives (means and standard deviations can be found in Appendix B).

TABLE 1. ANALYSIS OF VARIANCE SUMMARY OF THE GROUP PERFORMANCE COMPARISON ON IDENTIFIED ELAP OBJECTIVES* (NUMBER OF ITEMS CORRECT), SPRING, 1990.

ELAP Objective	Source	df	MS	F	SIGN. AT $\alpha < .05$
3. Convert Decimal, Percent, or Fraction	Group	1	10.3		
	Error	68	1.4	7.36	Yes
4. Determine Missing Base, Rate, or Percent	Group	1	9.2		
	Error	68	2.5	3.68	No
6. Determine Area, Volume, or Angle	Group	1	31.9		
	Error	68	1.5	21.3	Yes
7. Word Problems Involving Multi-cation of Decimals	Group	1	19.0		
	Error	68	1.5	12.7	Yes

*Objectives common to ELAP and Project Classroom Curriculum

From examining Table 1 and B.1, it can be seen that project participants performed significantly better than non-participants on three of the four (75%) common objectives, supporting the first hypothesis.

MATHEMATICS ATTITUDE

The second hypothesis was that participants would have a significantly better attitude toward mathematics than would non-participants. Table 2, below, presents the results of an ANOVA which examined differences in the groups' respective TOMA scores (means and standard deviations appear in Appendix C).

TABLE 2. ANALYSIS OF VARIANCE SUMMARY OF THE COMPARISON BY GROUP OF ATTITUDES TOWARD MATHEMATICS SPRING, 1990.

Variable	Source	df	MS	F	SIGN. AT $\alpha < .05$
TOMA Math Attitude Standard Scores	Group	1	0.3		
	Error	57	5.4	0.6	No

From examining Table 2, one can see there was no significant difference between the groups in their respective attitudes toward mathematics, a finding which rejects the second hypothesis.

INTERVIEW FINDINGS

After the six weeks had been completed, an evaluator interviewed the project teacher. The following points were raised during that interview:

- The project teacher received one day of training with the classroom computer system and software prior to the start of the class.
- While students enjoyed the experience of working with computers, they found the software dull.

- Other problems with the software were:

  - the software is tutorial in nature rather than offering practice or simulation;
  - it did not contain motivational prompts or statements;
  - the text contained in the program was often above the students' reading level;
  - response time between keystrokes was slow, and
  - the software did not contain enough review for students who did not grasp an objective.

- Because the classroom had only one interactive computer system, each student's access was limited, preventing full understanding and benefit from it.

- The project teacher felt that the expense of providing the classroom with enough of these interactive computer systems to adequately meet student needs was not cost effective when compared to purchasing sufficient APPLE computers which can use software already licensed to the district.

SUMMARY AND RECOMMENDATIONS

The School District of the City of Saginaw participated in the Laser Learning Project (LLP) the focus of which was to provide an alternative form of mathematics instruction. The six-week course used interactive computers and a specially designed curriculum which was aligned to four objectives defined as essential learnings by the district.

A study was conducted to determine whether students who participated in LLP evidenced significantly higher mathematics achievement and attitude scores than non-participating students.

It was found that participating students had significantly better mathematics achievement scores on three of the four (75%) objectives but there was no difference between participants and non-participants in mathematics attitude.

An interview with the project teacher added to the findings. Specifically, it was learned that project students did not have enough access to the computers and that the cost of fully equipping the classroom was substantially higher than another available alternative.

Based upon these findings, and those presented in the text, the following recommendations have been offered:

- Use the interactive system as a review rather than as part of the instruction.
- Due to the reading level of the text contained in the program, use the system in a high school setting.
- Provide students with access to more than one system and more time at a given setting. Employing APPLE computers may be a way to do this more cost effectively.
- Since significant differences were found for 75% of the objectives, this study should be replicated with the addition of more rigorous research controls.

APPENDICES

APPENDIX A

NINE OBJECTIVES DEFINED AS ESSENTIAL* AND TESTED ON
THE EIGHTH GRADE ELAP, MATHEMATICS SECTION

1) Given a line segment to measure within a closed figure, the learner will measure to the nearest unit of length.

2) Given an angle to measure within a closed figure, the learner will measure to the nearest degree.

3) Given fractions, decimals or percents of three place equivalence or less, the learner will convert to one of the other forms.

4) Given an appropriate problem involving percents the learner will determine the missing base, rate or percent.

5) Given a set of up to 6 whole numbers, the learner will find the mean (average).

6) Given an appropriate geometric figure/problem, the learner will determine the perimeter, circumference, area, volume, or angle measurement with formulas.

7) Given an appropriate word problem involving percents, the learner will solve the problem (multiplication of decimals).

8) Given a graph, the learner will use the data to answer questions.

9) Given an appropriate problem, the learner will determine the probability of an event.

---

*These objectives were defined as essential learnings for mathematics at eighth grade, second semester by eighth grade mathematics teachers and curriculum specialists.

APPENDIX B

TABLE B.1. MEANS AND STANDARD DEVIATIONS BY GROUP OF ITEMS CORRECT ON IDENTIFIED ELAP OBJECTIVES* SPRING, 1990.

ELAP Objective	Group			
	Project (n=48)		Control (n=22)	
	X	SD	X	SD
3. Convert Decimal, Percent, or Fraction	2.9	1.2	2.1	1.1
4. Determine Missing Base, Rate, or Percent	2.1	1.7	1.4	1.2
6. Determine Area, Volume, or Angle	2.5	1.8	1.0	0.9
7. Word Problems Involving Multi-cation of Decimals	1.9	1.4	0.8	0.8

*Objectives common to ELAP and project classroom curriculum

APPENDIX C

TABLE C.1. MEANS AND STANDARD DEVIATIONS BY GROUP OF TOMA MATHEMATICS ATTITUDE SCORES* SPRING, 1990.

Variable	Group	
	Project (n=37) X SD	Control (n=22) X SD
TOMA Math Attitude Score	8.7 2.4	8.9 2.4

*Scores are in standard score units